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Demographic antecedents and performance consequences of structural holes in work teams

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Summary This paper addresses two important questions concerning social fragmentation in work teams. First, from where do disconnections between team members, measured in terms of the proportion of structural holes within the work team, derive? Second, what are the consequences for team performance of having more or less structural holes between team members? In answering the first question, the research investigated whether demographic diversity in teams played a role in predicting the proportion of structural holes in team friendship networks. For 19 teams at a wood products company, there were no effects of ethnic and gender diversity on structural hole proportions. However, age diversity significantly reduced the extent of structural 'holeyness.' In investigating the second question, two countervailing tendencies were considered. In the absence of structural holes, teams are likely to be at low risk for new ideas. But fragmented teams in which team members are separated by many structural holes are likely to have difficulty coordinating. The researchers demonstrated a curvilinear effect: a moderate level of structural diversity in teams was positively associated with team performance. Thus, the research suggested that it is structural diversity (measured in terms of the proportion of structural holes) rather than demographic diversity that matters in the prediction of team performance. Copyright © 2006 John Wiley & Sons, Ltd.

Introduction

The extent to which individuals are connected to others is important for many aspects of human life. We know that isolated people tend to have higher mortality rates (Berkman & Syme, 1979), and that people with diverse networks of ties tend to have higher resistance to infection from the common cold (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). Social ties are important also for a range of economic

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activities such as getting a job (Granovetter, 1974) and negotiating a higher starting salary (Seidel, Polzer, & Stewart, 2000). Indeed, formal organizations themselves comprise not only systems of designated authority relations, but also systems of informal relations between employees. Classic studies of organizational behavior have revealed the importance of informal networks for understanding such outcomes as work restriction (Roethlisberger & Dickson, 1939), strike action (Kapferer, 1972), job satisfaction (Roy, 1954), and performance ratings (Barsness, Diekmann, & Seidel, 2005).

Recently, organizational research on social networks has tended to focus on the question of whether some positions in social networks are better than others. Building from the work of Brass (1984) on the importance of 'being in the right place,' research has investigated the consequences for individuals of occupying positions in social networks that bridge across social divides. To the extent that an employee spans across interpersonal gaps (or 'structural holes' as Burt, 1992, refers to them), connecting otherwise disconnected individuals, the employee may perform a useful service to the organization and thereby gain higher performance ratings from supervisors (Mehra, Kilduff, & Brass, 2001). The emphasis has been on the personal benefits that accrue to occupants of go-between positions. Benefits to go-betweens include not only higher performance ratings, but also faster promotions (Burt, 1992; Podolny & Baron, 1997).

The discussion in the organizational literature has tended to focus on individual actors' positions in social networks and the consequences for actors of occupying one type of position rather than another. But structural holes can also be seen as symptoms of system-level fragmentation (Burt & Ronchi, 1990) and impediments to the effective mobilization of collective resources (Granovetter, 1973; Portes, 2000). Neglected issues in the organizational literature include how fragmentation within units such as teams originates and how such fragmentation affects outcomes at the unit level. To gain a better understanding of why some organizational units tend to have more structural holes than others requires comparing across organizational units rather than focusing on actors' relations within one unit. Similarly, to understand the effects of structural holes on organizational functioning requires moving beyond a consideration of individual actor strategies to consider the social unit as an aggregate social system.

If we take the organizational team as the unit of analysis, we can address two questions. First, from where do structural holes within the team derive? And second, what are the consequences for team performance of having more or less structural holes between team members? These questions redirect attention from the individual's pattern of ties to the composition of the team. The issue becomes not how individuals structure their networks for individual advantage, but how interactions of individuals within the team affect team outcomes. By focusing on the formation and presence of structural holes in teams, we seek to develop a better understanding of the causes of social fragmentation in teams and the consequences of such fragmentation for team performance.

Theory

Structural hole antecedents

Ethnic and gender diversity

Problems of fragmentation are common in organizations (see the discussion in Krackhardt & Hanson, 1993: 110). Discrete groups of informally linked employees form bonds of friendship and trust (e.g., White, 1961). In the absence of strong ties between these groups, little tacit knowledge or expertise is

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likely to flow (Hansen, 1999). The antecedents of such fragmentation remain largely unstudied according to organizational theorists (e.g., Salancik, 1995), but we do have considerable information concerning why people tend to cluster together. The basic idea is simple, is often referred to as the homophily principle, and is particularly applicable to sentiment relationships such as the friendship networks studied in this paper (Blau, 1977; Ibarra, 1992). The homophily principle states that people like to associate with others who are similar. Similar others are helpful in evaluating one's ideas and abilities, especially when important consequences are at stake (Festinger, 1954).

The bases upon which people can choose similar others are, of course, many (Williams & O'Reilly, 1998). Among the most salient bases of social interaction in organizational settings are ethnicity and gender (Ibarra, 1992; McGuire, McGuire, Child, & Fujimoto, 1978). The theoretical explanations on which much of this work resides are social identity and social categorization theory (Tajfel & Turner, 1986) and similarity-attraction theory (Byrne, 1971). According to social identity and self-categorization theory, individuals classify themselves and others into social categories using highly salient characteristics such as age, sex, and race (Tajfel & Turner, 1986). To maintain a positive social identity, individuals seek to maximize intergroup distinctiveness and see out-group (dissimilar) members as less attractive (Tajfel & Turner, 1986). Consequently, individuals of the same sex (Ibarra, 1992) and same race (Lincoln & Miller, 1979) are more likely to associate with one another and interact more frequently. Indeed, demographic similarity increases the frequency (Ibarra, 1992) and quality of interaction (Tsui & O'Reilly, 1989) between individuals and has been associated with higher levels of trust (Jehn & Mannix, 2001; Jehn et al., 1999; Pelled, 1996). Friendship networks in organizational settings typically exhibit clusters of people similar on salient demographic variables of gender and race (Gibbons & Olk, 2003; Lincoln & Miller, 1979; Mehra, Kilduff, & Brass, 1998).

In summary, the literature on homophily pressures in organizations shows that, in general, people tend to make friends with those similar on such salient attributes as ethnicity and gender. At the level of the team, therefore, diversity on such characteristics is likely to affect the structure of friendship relations. The more diverse the team with respect to ethnicity and gender, the more likely the team is to exhibit social fragmentation.

Hypothesis 1a. The greater the ethnic diversity of the team, the higher the proportion of structural holes in the team's friendship network.

Hypothesis 1b. The greater the gender diversity of the team, the higher the proportion of structural holes in the team's friendship network.

Age diversity

The effects of age diversity on team fragmentation are likely to be complex. On the one hand, the general homophily argument would suggest that people in teams would tend to associate on the basis of age similarity given that people of the same age (relative to people from different age brackets) tend to have more in common with each other with respect to norms, values, experiences, and topics of conversation (see the arguments in Bantel & Jackson, 1989; Tsui, Egan, & O'Reilly, 1992; Wagner, Pfeffer, & O'Reilly, 1984). We know that people of similar ages in work teams tend to communicate more frequently on technical matters (Zenger & Lawrence, 1989). In teams containing people from different age categories, people of different ages may categorize each other on the basis of age stereotypes, and this categorization may contribute to conflict within the team (see the argument in Pelled, Eisenhardt, & Xin, 1999). Thus, the greater the age heterogeneity of the team, the greater the social fragmentation we might expect.

On the other hand, a social comparison theory perspective (Festinger, 1954) might lead us to suggest that people of the same age would regard each other as competitors within the group for valued roles and promotions. As a recent study explained, age diversity can have unexpectedly negative effects on

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work group conflict: 'When age similarity in a group increases, these career progress comparisons, which prompt jealous rivalry, often increase' (Pelled et al., 1999: 21). Previous researchers have also suggested that age similarity in teams might promote interpersonal rivalry and conflict (Hambrick, 1994; Lawrence, 1997).

Age diversity within the team can also provide the opportunity for mentoring activity between older and younger employees. Recent research (that failed to look at social fragmentation) showed a significantly positive effect of age diversity on performance outcomes within teams (Kilduff, Angelmar, & Mehra, 2000). The overly competitive behavior of younger employees towards peers may be reduced in the presence of older team members (Chattopadhyay, 1999; Finkelstein, Burke, & Raju, 1995). Teams heterogeneous with respect to age may be better able than more homogenous teams to promote cohesion across social divides.

Thus, we recognize the existence of conflicting lines of argument with respect to the effects of age heterogeneity within teams, and like researchers before us (e.g., Bantel & Jackson, 1989), are led to propose two opposing hypotheses concerning age diversity.

Hypothesis 2a. The greater the age diversity of the team, the higher the proportion of structural holes in the team's friendship network.

Hypothesis 2b. The greater the age diversity of the team, the lower the proportion of structural holes in the team's friendship network.

Structural holes and team performance

What are the effects of structural holes within teams on the performance of teams? Despite the importance of this question, it has been neglected both theoretically and empirically. We know that structural holes can represent opportunities for individual people (Burt, 1992) and that individuals who span across such holes in friendship networks can gain enhanced performance ratings (Mehra et al., 2001). But we also know that these positive effects of structural holes within an individual's personal network are contingent upon the extent to which the market for information within the network is relatively inefficient (Burt, 1992) and the extent to which the members of the network are relatively unimportant for the completion of the individual's work initiatives (Podolny & Baron, 1997). Thus, the benefits of spanning across structural holes at the individual level can under some circumstances be replaced by costs such as missed promotions and job dissatisfaction (Podolny & Baron, 1997).

The benefits of structural holes

A close reading of structural hole theory suggests both positive and negative effects of structural holes on performance at the team level of analysis. Too much or too little 'holeyness' can, we suggest, negatively affect performance in teams. On the positive side, teams with structural holes may exhibit distinctive knowledge production within different parts of the team (cf. Burt, 2004). To the extent that new knowledge develops through synergies at the interstices of distinctive units (Powell, Koput, & Smith-Doerr, 1996), teams with pockets of diverse information and knowledge may prove to be potent producers of novel solutions. Separated units within the team may develop different ways of understanding and solving problems. Further, coordination within the team through informal network links can be achieved more efficiently through brokerage within a sparsely connected network (that exhibits structural holes) than through cohesion within a densely connected network (Burt, 1992). There is, therefore, the potential for structural holes within teams to be associated with a greater variety of problem solutions combined with a more efficient process of informal coordination. The absorptive

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capacity of the team in terms of its ability to both generate and utilize innovative solutions can be enhanced by the presence of structural holes (cf. Burt, 2005). Team performance, therefore, may be positively related to the presence of structural holes in teams.

Further, structural holes in teams can help prevent the overly restrictive enforcement of norms that occurs as team members come under close surveillance from mutual friends (Krackhardt, 1999). If structural holes are absent, sets of routines taken for granted by cohesive team members may ossify into rigid rules (Barker, 1993). Diversity of views and openness to new ideas within the group are, therefore, likely to be protected by the presence of structural holes in teams. Teams that lack structural holes tend to be disinclined to accept ideas originating from outside the team (Oh, Chung, & Labianca, 2004) and tend to view non-group members negatively (Sherif, 1961). The presence of structural holes within a team can facilitate increases in the team's ability to produce or absorb new problem solutions.

The detriments of structural holes

At the other extreme, teams that are full of structural holes may exhibit social system breakdown or may be overly reliant on brokers for team coordination. Fragmented teams in which there are gaps between individuals and subgroups may experience difficulty in communication and in coordination. Diverse ideas and important information may fail to cross gaps between isolated individuals or disconnected clusters of people. Such fragmented teams may lack overall coordination, and this absence of coordination may impair team performance.

To the extent that teams are heavily reliant on brokers to span across structural holes between isolated individuals or clusters of individuals, there may also be some negative effects on performance. Brokers can engage in calculated or involuntary filtering, distortion, and hoarding (cf. Baker & Iyer, 1992; Burt, 1992) as they transmit information and knowledge across the team. Further, as one case study (Cross & Parker, 2004) illustrated, brokers who span across disconnected subgroups within a team can be overwhelmed by the coordination task, producing bottlenecks in the flow of communication that adversely affect team performance. Teams that rely on brokers can suffer performance decrements when brokers are particularly busy or when they are absent.

Thus, from a cohesion perspective (cf. Coleman, 1990), there is an argument to be made for team structures that avoid structural holes in favor of cliquishness. A cohesive team with no structural holes in which everyone is connected to everyone else constitutes a clique. Such a team structure offers multiple pathways for communication and coordination, potentially enhancing team performance. In one research study, teams in which all members were friends with each other exhibited higher levels of communication and cooperation compared with teams composed of acquaintances (Shah & Jehn, 1993). Friendship teams relative to acquaintance-based teams exhibit more task monitoring, less social loafing, and higher group performance (Weldon, Jehn, & Shah, 1991).

A curvilinear approach

To make sense of these diverse theoretical ideas and empirical results, we suggest a curvilinear model of how structural holes are likely to affect team performance. Teams with extremes in terms of too high or too low of a proportion of structural holes in friendship networks are likely to have low performance. In between the two extremes of fragmentation and cliques are teams characterized by moderate levels of structural holes. In such moderately 'holey' teams, there are some gaps between people who have friends in common. There is some clustering of people, and some reliance on brokers to span across disconnected team members. The team is likely to have some useful redundancy in brokerage because of the moderate level of connections between team members. There is little likelihood that any one broker can distort information from one team member to another on a consistent basis. Such teams may

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gain the benefits of diverse thinking without the drawbacks of information distortion or poor coordination. People in such teams may find opportunities for some degree of clustering with like-minded others without having to suffer social isolation. A moderate level of structural holes in friendship networks, we suggest, may be associated with relatively high levels of team performance.

Hypothesis 3. There will be a curvilinear relationship between the proportion of structural holes in friendship networks in teams and team performance such that low and high proportions of structural holes will be associated with lower team performance than moderate levels of structural holes.

Organizational Context

The research site was a *Fortune*-100 manufacturer of paper and wood-based building products that were sold directly to retail outlets such as building materials dealers and home improvement centers (e.g., Lowe's and Home Depot). At the time of the study, powerful home improvement retailers were exerting considerable pressure on manufacturers to reduce prices, adopt just-in-time delivery, etc. However, manufacturers in this industry experienced relatively strong sales and profits prior to and during data collection. Demand was primarily driven by new home construction and residential repair and remodeling.

Manufacturing Environment

The primary raw materials at this site were wood fiber and a glue-like resin. Logs were delivered by truck and off-loaded into yards. Logs were then processed into small chips that were dried, pressed, and converted into finished products. These products were packaged and shipped via rail or truck to the next stage in the distribution chain.

The production process was extensively automated, but variation in raw materials and environmental conditions required production employees to pay attention to moisture content, appearance, dimensions, and quality. Many of the jobs were dangerous with a constant risk of fire and explosion if process parameters were not managed correctly. Human decision-making and intervention were necessary at all stages of the operation, with many decisions made in collaboration with supervisors or co-workers.

The production floors were noisy and dusty, with strong odors from the resins. Approximately one quarter of production employees worked shifts in climate-controlled rooms where they monitored and controlled operations via computerized systems. A few of the workers spent parts of their shifts working outdoors. Personal safety equipment such as hearing and eye protection were mandatory in most parts of the plants, and in some areas hardhats were also required.

All production employees, supervisors, and production managers had access to two-way radios for internal communication; these were generally worn on the belt with a corded microphone/speaker system worn over the shoulder (much like police officers use). Radio communication was important due to the physical distance between workers and the importance of immediate communication between group members.

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Methods

Sample

The sample consisted of 336 employees (in 23 teams). The average age of employees was 36 years (SD = 9) with an average organizational tenure of 4.6 years (SD = 9). The average worker had 13 years of education (SD = 1.38). Only 12 per cent of the employees had at least a university education. Twenty-six per cent of employees were female. Sixty-five per cent of the sample was white and 32 per cent was black.

The teams were segmented into two types: shift teams and support teams. Shift teams were directly responsible for making product and keeping the plants running 24/7. Support teams (e.g., maintenance, electrical) included people who provided specialized assistance to the shift teams. Much of the work of shift teams consisted of preventative maintenance and other routine tasks, but some work was more urgent (e.g., something had broken and needed to be fixed immediately). All teams experienced high levels of within-team task interdependence.

Of the 23 teams, 2 consisted entirely of members of top management with only 4 members for each team. These two teams were qualitatively different from the rest and were dropped from analysis. In addition, we dropped two other teams due to missing performance data. The members of these 2 groups did not differ from the members of the remaining 19 teams on several dimensions including organizational tenure, team tenure, and age. Thus, we had usable data from 19 teams (with 295 individual respondents) that were involved either in the actual manufacturing process or in support functions.

Procedure

We arranged for questionnaires to be distributed 1 hour prior to one of the regular daily team meetings. Participation in the study was voluntary and respondents were assured of confidentiality. Individuals who could not complete the questionnaire during the allotted 1-hour time period were allowed to complete it at home and return it by mail directly to the researchers via a postage paid envelope provided in the survey packet. We gathered these data over a 1-week period. The response rate was 88 per cent. Of the 19 teams, 18 had a response rate equal to or greater than 75 per cent. Dropping the team with the lowest response rate did not change the results and therefore, we retained it.

Measures

Ethnic and gender diversity

We used data from the company records to code each individual's ethnicity (1 = African American, 2 = White, 3 = other) and gender (1 = male, 2 = female). From these categorical data, for each team, we computed Blau's (1977) index of heterogeneity (see Jackson et al., 1991 for details) for both ethnicity and gender. Blau's index can vary from 0 (indicating all team members are the same) to a high of 1 (indicating all team members are different).

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Age diversity
Using data from company records, for each team, we computed the standard deviation of members' ages, a measure recommended for samples that exhibit varying team size (Bedeian & Mossholder, 2000).

Social network ties
We asked employees to look through a list of team members and identify their friends. A friendship tie was considered to exist only if both individuals agreed they were friends. We constructed 19 friendship matrices, 1 for each team, to capture these friendship data. Cell X_{ij} in the friendship matrices represented whether i and j were friends (cell value = 1) or not (cell value = 0).

Structural holes
We build on the extensive literature on transitivity in triads that has investigated the prevalence of structural holes (e.g., Baker & Obstfeld, 1999) to define a structural hole as the absence of either one, two, or three connections between the three members of a triad. A triad in which a focal individual has two friends not joined by any friendship connection represents the 'forbidden triad' discussed by Granovetter (1973)—the brokerage structure that forms one basis for structural hole theory (Burt, 1992). Those triads in which either two or three ties are missing also signal the presence of structural holes in terms of gaps between team members not spanned by any third party.

We operationalized the proportion of structural holes in each team as the number of intransitive triads and vacuously transitive triads divided by the number of triples of all kind (see Holland & Leinhardt, 1970: 496). A triad is intransitive if for any three actors i, j, and k, the following conditions are true: i and j are friends, j and k are friends, but k and i are not friends. However, the two types of vacuously transitive triads that were measured here are those triads in which actors i, j, and k are not connected to each other (e.g., three isolates) and those triads in which actors i, j are connected but k is not connected to either (e.g., members of two unconnected subgroups). We calculated the structural hole score for each team using the following formula: $T = (IT + VT)/(IT + VT + NT)$, where IT is the number of intransitive triads, VT is the number of vacuously transitive triads, and NT is the number of transitive triads. For each team, this ratio ranged from 0 to 1, with low values reflecting few structural holes and high values reflecting many structural holes.

Dependent variables

Team performance
Team supervisors were asked to rate their teams on a scale of 1 (very poor) to 5 (very good) for five items measuring team performance (Campion, Papper, & Medsker, 1996). Sample questions included 'The quality of work done by this team was. . ..' In the present study, the scale's reliability as measured by Cronbach's (1951) alpha was 0.77. The scores for all 5 items were averaged for each of the 19 teams.

Control variables

Size
Size has been used to predict network properties and team performance (Friedkin, 1981; Guzzo & Dickson, 1996) and was, therefore, controlled for in our analyses. In our sample, team size was bimodally distributed. Nine teams were small to medium in size (4–11 members) whereas 10 teams were large in size (19–23 members). In controlling for size in our regression analyses, we found that an

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operationalization that represented this bimodal size distribution explained more variance than other operationalizations of size (including a continuous measure of team size). Therefore, we represented size with a dichotomous variable coded '1' for teams with 11 or fewer members, and '2' for teams with 19 or more members.

Team tenure

Team tenure has been associated with team performance (Watson, Michaelson, & Sharp, 1991). Therefore, we created a control variable as follows: team tenure was set equal to the number of years each team had existed. Data were provided by team supervisors, or (in the case of missing data) by the self-reports of team members.

Analysis

This study is based on 295 individuals, but the sample size for the purpose of analysis is 19 teams. Given that the average sample size of studies involving work teams is 60 teams (Cohen & Bailey, 1997), we investigated standards for power and significance levels. The results of a power analysis found that there would be a 25 per cent chance for detecting moderate effect sizes, with a sample of 19 with a $p < 0.05$ (two-tailed test). However, on increasing the p-value to $p < 0.10$, the chance for detecting moderate effect sizes went up to 37 per cent, which is similar to the power reported in other studies (Sedlmeier & Gigerenzer, 1989). Therefore, given our sample size, we took extra precautions to avoid incorrectly rejecting a hypothesis by using $p < 0.10$ (two-tailed). Further, to facilitate the interpretation of the results, we provide the standard errors for the beta weights that can be used to calculate confidence intervals (Schmidt, 1996; Wilkinson & the Task Force on Statistical Interference, 1999).

An additional concern was that the sample size might lead to a violation of the normality assumption central to the ordinary least square procedure. To check for non-normal distributions, we examined the skewness and kurtosis of all the variables. All the measures had normal distributions with deviations from normality within acceptable ranges (± 3 for skewness and ± 7 for kurtosis), suggesting that the data did not violate the normality distribution (West, Finch, & Curran, 1995).

To identify potential statistical outliers that might skew the results, we developed box plots for all the measures. All but one relationship had no statistical outliers. Two outliers were identified for the relationship between team fragmentation and team performance. All the analyses were conducted with and without the outliers. Because the results did not change when the outliers were dropped, we present the results with the complete sample.

This study uses multiple sources of data to avoid inflated correlations due to mono-method bias. Team tenure and team performance were based on the information provided by the supervisors. Archival sources were used to develop the ethnic, gender, and age diversity measures. The structural hole variable was based on the friendship data provided by each member of the team.

In order to test the third hypothesis, which suggests an inverted U-shaped relationship between structural holes and performance, we computed the square of the structural hole term and then included it in a regression model along with the linear term. To support the third hypothesis, the squared term had to be statistically significant and had to have a negative coefficient (Agresti & Finlay, 1997). In order to reduce possible multi-collinearity, we centered the structural hole variable and the squared term (Aiken & West, 1991). Centering involves subtracting the means of the respective independent variables. Even though this did not change the results, we retained the centered model.

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Results

Table 1 shows the means, standard deviations, and zero-order correlations between the variables. The typical team had existed for around 3 years. Teams with structural holes in friendship networks tended to be of recent formation ($r = -0.39$, $p < 0.10$), to contain many people ($r = 0.47$, $p < 0.05$), to exhibit diversity across ethnic categories ($r = 0.42$, $p < 0.10$), and to contain people of similar ages ($r = -0.47$, $p < 0.05$). Long-established teams, relative to those of more recent formation, tended to be high-performing ($r = 0.40$, $p < 0.10$).

Moving beyond these zero-order results, the multiple regression analyses summarized in Tables 2 and 3 represent the tests of our hypotheses. Recall that hypothesis 1a suggested that ethnically diverse teams would have more structural holes than ethnically homogenous teams. Table 2, Model 2, shows no support for this hypothesis (beta = 0.10, ns). Similarly, as is shown in Table 2, Model 3, we found no support for hypothesis 1b's prediction that teams with more gender diversity would exhibit a greater proportion of structural holes (beta = −0.03, ns).

How did the age diversity of the team relate to team holeyness given the opposing predictions summarized in the two parts of hypothesis 2? The results in Table 2, Model 4, show that teams containing people of different ages (relative to teams containing people of similar ages) tended to exhibit fewer structural holes (beta = −0.01, $p < 0.01$). Thus, Hypothesis 2b was supported. Model 4 in Table 2 explained 71 per cent of the adjusted variance in the proportion of structural holes in teams. Larger teams tended to have a higher proportion of structural holes (beta = 0.05, $p < 0.01$), whereas longer-tenured teams tended to have a lower proportion of structural holes (beta = −0.01, $p < 0.01$). The results in Table 2, Model 5, show that age diversity, team size, and team tenure continued to be significant predictors even controlling for ethnic and gender diversity.

Thus, teams of large size and teams in existence for relatively short periods of time tended to exhibit more fragmentation in terms of a higher proportion of friendship network structural holes. Further, teams that contained a mixture of both young and old workers tended to have less holeyness than teams in which people were similar with respect to age. Teams with more ethnic or gender diversity relative to teams with less such diversity were no different with respect to the prevalence of structural holes.

Do demographic diversity and structural holeyness matter—are there effects on team performance? This is the question addressed in Table 3. Models 2–4 in Table 3 show no significant effects on team performance of ethnic, gender, or age diversity, respectively. Demographic diversity, therefore, was not significantly related to team performance. Hypothesis 3 suggested that teams with low or high

Table 1. Descriptive statistics and correlations[a]

Variable	Mean	SD	1	2	3	4	5	6
Size	1.53	5.13						
Tenure	2.76	1.62	−0.19					
Diversity								
Ethnic	0.40	0.13	0.35	−0.05				
Gender	0.26	0.19	−0.22	−0.18	0.24			
Age	7.66	2.52	0.22	−0.24	−0.24	0.25		
Structural holes	0.97	0.04	0.47*	−0.39+	0.42+	−0.16	−0.47*	
Performance	4.18	0.43	−0.34	0.40+	−0.36	−0.34	−0.15	−0.38

[a] $n = 19$.
+ $p < 0.10$.
* $p < 0.05$.

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Table 2. Results of linear regression analysis predicting structural holes in teams[a]

	Model				
Variable	1	2	3	4	5
Size	0.03^{+} (0.02)	0.03 (0.02)	0.03 (0.02)	0.05** (0.02)	0.05** (0.02)
Tenure	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	−0.01** (0.00)	−0.01** (0.00)
Diversity					
Ethnic		0.10 (0.07)			0.00 (0.06)
Gender			−0.03 (0.05)		0.01 (0.04)
Age				−0.01** (0.00)	−0.01** (0.00)
F	3.70	3.27	2.49	16.02	8.55
Adjusted R^2	0.23*	0.28^{+}	0.20^{+}	0.71**	0.68**

[a]$n = 19$ (two-tailed tests); standard errors are in parentheses.
$^{+}p < 0.10$.
$^{*}p < 0.05$.
$^{**}p < 0.01$.

proportions of structural holes would be poorer performers than teams with moderate proportions of structural holes. Looking at Table 3, Model 5, we find support for this curvilinear hypothesis: the squared term was negative and significant ($p < 0.01$), whereas the linear term was positive and significant ($p < 0.01$). The addition of the network holeyness variables in Model 5 increased the explained variance by 30 per cent over the baseline Model 1.

Previous research has measured 'closure' in work teams as the density of close socializing relationships, that is as the sum of actual team ties divided by the total possible sum of ties among all members in the team (Oh et al., 2004). But this measure does not capture the extent to which teams exhibit structural holes. It is possible that two teams could have precisely the same density of ties, but quite different proportions of structural holes. Therefore, we preferred to measure the proportion of structural holes directly rather than rely on a general measure of density. In the current study, the pattern of significant results concerning the effects of structural holes on team performance remained

Table 3. Results of linear regression analysis predicting team performance[a]

	Model				
Variable	1	2	3	4	5
Size	−0.23 (0.19)	−0.15 (0.20)	−0.31 (0.18)	−0.23 (0.20)	−0.26 (0.17)
Tenure	0.09 (0.06)	0.09 (0.06)	0.07 (0.06)	0.09 (0.06)	0.00 (0.06)
Diversity					
Ethnic		−0.94 (0.78)			
Gender			−0.84 (0.49)		
Age				0.00 (0.04)	
Structural holes					266.75** (85.30)
Structural holes^2					−143.17** (45.47)
F	2.44	2.15	2.83	1.53	4.51
Adjusted R^2	0.14	0.16	0.23^{+}	0.08	0.44*

[a]$n = 19$ (two-tailed tests); standard errors are in parentheses.
$^{+}p < 0.10$.
$^{*}p < 0.05$.
$^{**}p < 0.01$.

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unchanged irrespective of whether or not we controlled for the extent of team friendship network density.

In summary, therefore, Table 3 shows that work teams with either too little or too much holeyness in friendship networks tended to perform at a lower level than teams characterized by moderate levels of structural holes. To further investigate the curvilinear effects of structural holes on team performance, we examined the friendship sociograms (Borgatti, Everett, & Freeman, 2002) for a range of teams from our sample. To illustrate the situation of teams exhibiting low performance and either a low or a high proportion of structural holes, we provide the sociograms in Figures 1 and 2. The low-performing team depicted in Figure 1 exhibits a cohesive social structure that features a relatively low proportion of structural holes with four of the five members embedded in at least one three-person clique. The low-performing team depicted in Figure 2 exhibits a fragmented social structure that features a relatively high proportion of structural holes manifested in the separation of the team in two separate parts. In contrast to the teams in Figures 1 and 2, the high-performing team illustrated in Figure 3 exhibits a dispersed social structure, with a moderate number of structural holes, spanned by central actors such as the individual we have named Glen.

Overall, the results suggest that teams that were diverse in age tended to have fewer structural holes. These structural holes had important performance implications. Teams with low or high proportions of structural holes tended to be poorer performers compared with teams exhibiting moderate proportions of structural holes.

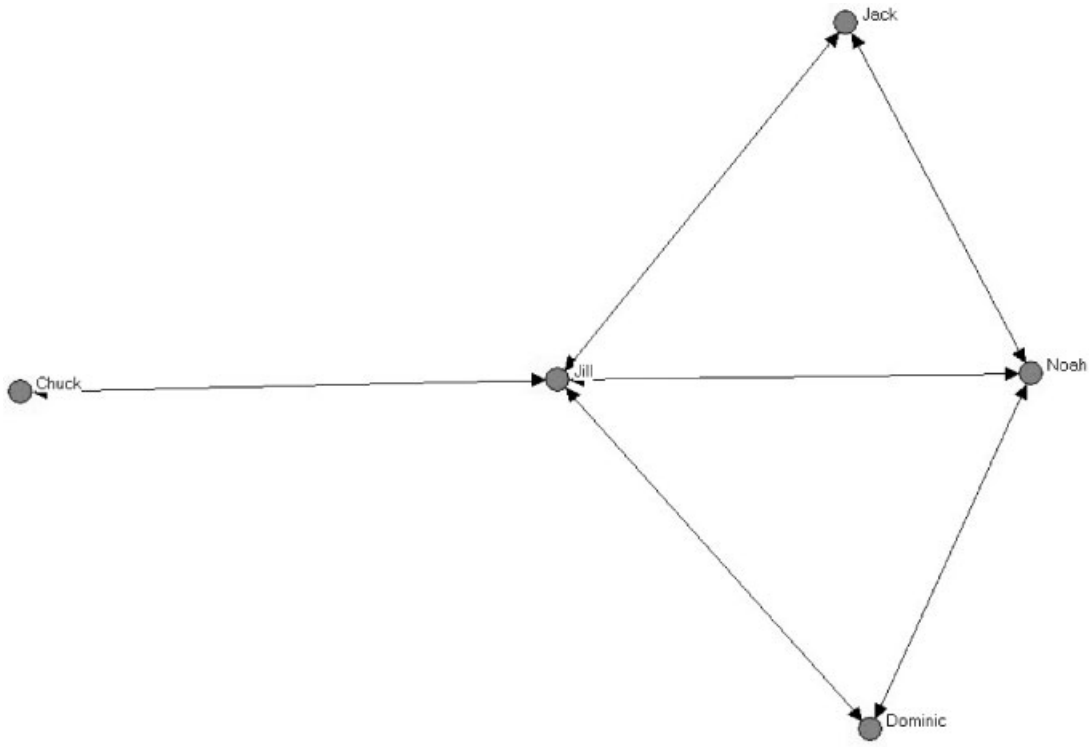

Figure 1. Team with low proportion of structural holes and low performance

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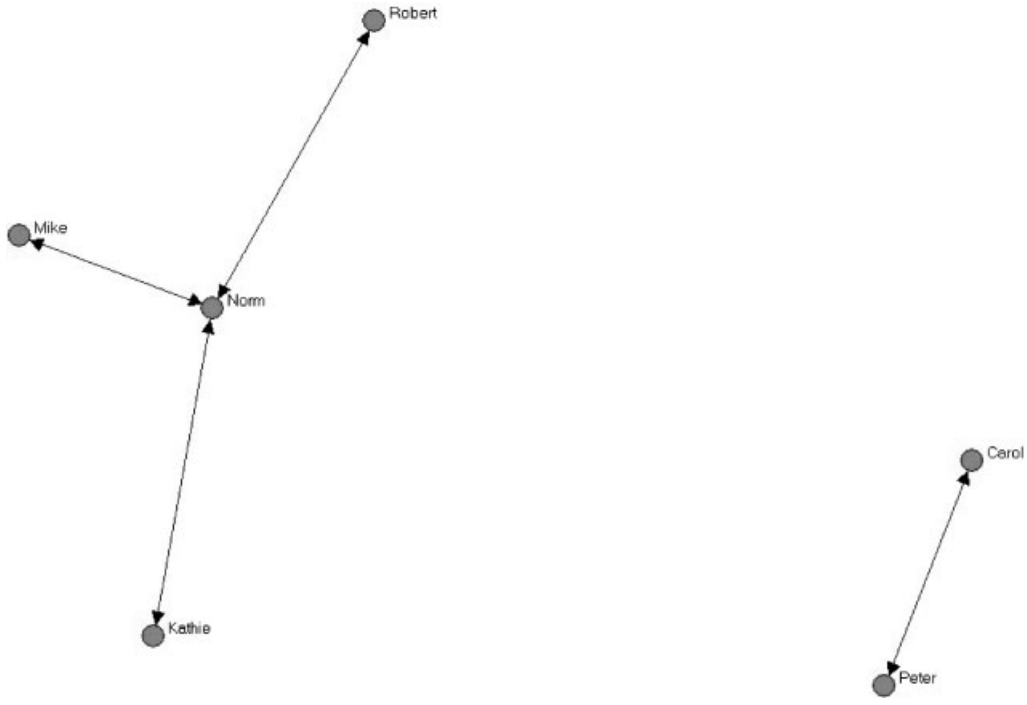

Figure 2. Team with high proportion of structural holes and low performance

Discussion

There are many kinds of diversity that can be examined in work teams including demographic diversity and structural (social network) diversity (Mannix & Neale, 2005). In terms of differences that really make a difference to the performance of the team, our findings suggest that it is structural diversity rather than demographic diversity that matters. The configuration of the team can be examined to see whether it is structurally homogenous (very few structural holes) or structurally heterogenous (many structural holes). Both of these extreme configurations are likely to impair team performance. In the absence of structural holes, teams are likely to be at low risk for new ideas and innovative solutions to problems (see the argument in Burt, 2005). But fragmented teams in which team members are separated by many structural holes are likely to have difficulty coordinating and communicating (cf. Krackhardt & Hanson, 1993). Thus, we proposed and demonstrated that a moderate level of structural diversity in teams is positively associated with team performance.

The contribution of this research is twofold, in that it investigated structural hole effects on team performance and examined the possible origins of such structural holes. Given the omnipresence of work teams in organizational settings, the structural configuration of such teams has begun to excite research interest (e.g., Balkundi & Harrison, 2006; Barrick, Stewart, Neubert, & Mount, 1998). Our research spotlights the hitherto neglected structural consequences of older and younger people included in the same work team. The results imply that, irrespective of whether or not a team exhibits high ethnic or gender diversity, the presence of age diversity can protect the team from fragmentation.

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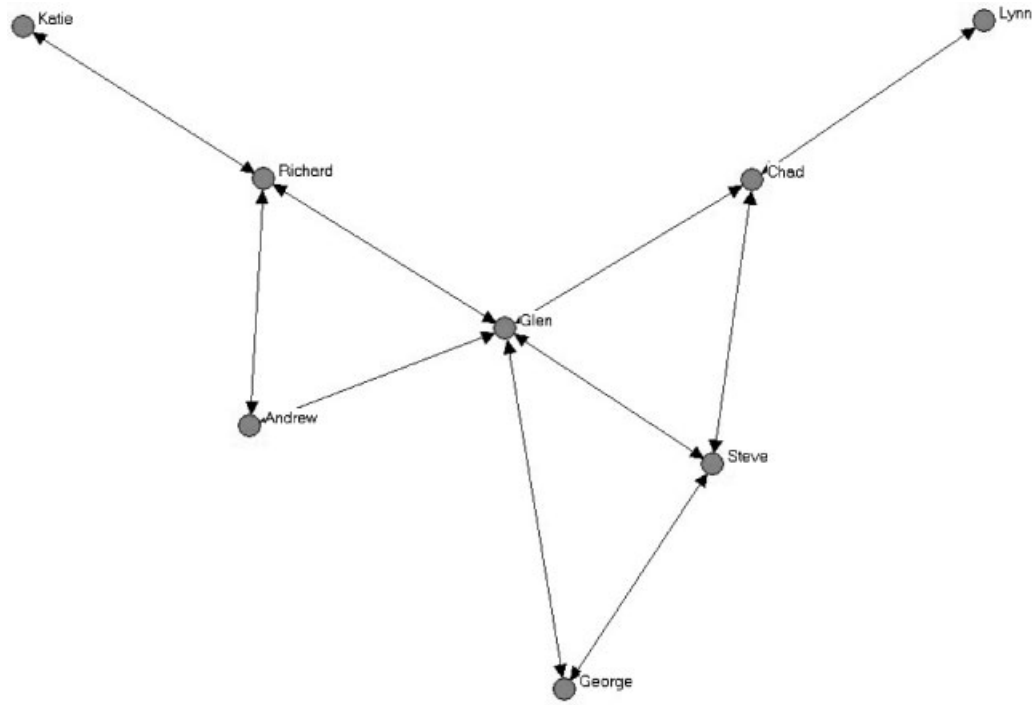

Figure 3. Team with moderate proportion of structural holes and high performance

Left unanswered in our research is the question of why age diversity in teams should be associated with less fragmentation. Possibly, older members of the team provide mentoring for younger members, or the combination of different age groups lessens within-cohort rivalry. From animal studies, we know that the presence of older members of the herd can reduce destructive behavior by younger members (Slotow, Van Dyk, Poole, Page, & Klocke, 2000).

We found no significant effects of ethnic diversity or gender diversity on the structural configuration of teams. Previous research has cast doubt on the suggestion that the demographic diversity of the team reflects cognitive or attitudinal diversity (e.g., Harrison, Price, Gavin, & Florey, 2002; Kilduff et al., 2000). In work teams characterized both by daily interaction and competition with other teams (even if that competition is friendly, as it was in this organization), the importance of surface level indicators of difference such as ethnicity or gender may be less apparent than in other social circumstances such as organization-wide social networks (cf., Mehra et al., 1998). The team literature, to the extent that it has emphasized the importance of demographic differences as proxies for underlying social fragmentation, has tended to be influenced by theory and research (e.g., Bantel & Jackson, 1989; Hambrick & Mason, 1984; Michel & Hambrick, 1992) concerning a very unusual type of team—the top management team—which does not engage in the kind of daily routine work interaction characteristic of other types of organizational teams. The social network approach to team interaction allows for more specific theory and more direct measures of team cohesion and fragmentation than is possible from the team demography approach.

The social network approach, to the extent that it captures the social structure of the team, may also contribute to a better understanding of team performance than is possible from the demography approach. A recent meta-analysis of 76 studies found that demographic diversity (including age, gender, and ethnicity) had no effects on team performance (Webber & Donahue, 2001). Our results, showing significant effects of network configuration on team performance, are consistent with

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emerging research concerning social capital and organizational performance at the team level (e.g., Oh et al., 2004; Oh, Labianca, & Chung, 2006). Structural holes in teams may be better indicators of faultlines that divide team members than the more surface level demographic variables that have been emphasized previously (cf. Lau & Murnighan, 1998).

In directing attention to the structural hole configuration of the team, our research is part of a new wave of thinking concerning team-level social capital (e.g., Shah, Dirks, & Chervany, 2006) that extends previous emphases on structural holes surrounding the individual person (Burt, 1992) or organization (Ahuja, 2000). As part of this research, we present a new measure of the 'holeyness' of teams that goes beyond the standard measurement of the extent of the 'forbidden triad' (the absence of a tie between two people with a mutual friend—Granovetter, 1973) and beyond the simple measure of density to incorporate the triad of isolates (three isolated individuals) and the disconnected triad (a connected dyad plus one isolate). We raise the question for future research of how the prevalence of these different types of structural holes affects performance outcomes.

Future research needs to explore other critical team level features that are relevant to the emergence of structural holes in the team. One such aspect would be the role that formal team leaders play in the creation and decay of structural holes. Could it be that certain leaders (such as transformational leaders or those who are high self-monitors) are better at bridging networks in their teams (see Balkundi & Kilduff, 2005, for an extended discussion)? Studies need to explore whether successful leaders are those who are able to maintain requisite variety in the social structure of teams.

One important area for future research concerns a more exact understanding of how the topography of structural holes in teams relates to the production of new and creative ideas. Current research concerning the effects of structural holes on individual creativity in organizations emphasizes the importance of the immediate network of ties around the individual, and the relative lack of importance of structural holes among more distant contacts (Burt, 2007). To the extent that the individual can control his or her social ties to span across disconnected others, then the individual remains likely to benefit from the transmission of ideas across these disconnected contacts. At the team level of analysis, it may be that the team leader can foster diversity of idea production among relatively isolated cliques within the team while communicating ideas across the team, thus capturing the benefits of team holeyness without paying the price of fragmentation. Further, the structure of contacts between the team leader and other individuals and teams may have profound effects on team creativity and productivity (Mehra, Dixon, Brass, & Robertson, 2006).

Ever since Coleman's (1990) discussion of the cross-level implications of social capital, researchers have called for more research concerning how the networks of individual actors affect the outcomes of the collectivity (e.g., Ibarra, Kilduff, & Tsai, 2005; Portes, 2000). In the current research, the structure of individual friendship networks was found to have effects at the group level. By forming personal friendship bonds, individuals are, therefore, potentially affecting the performance of the teams to which they belong. Unforeseen organizational consequences may flow from team members' personal choices.

The exclusively blue-collar nature of our sample raises the question of generalizability. Specifically, are social networks different for members of our sample compared to members of more managerial samples? Certainly, the configuration of ties across social settings including work settings differs for managers and non-managers. Managers report more structural holes between their social contacts (across the full range of work and non-work settings), while non-managers derive income benefits at work to the extent that they participate in larger coworker discussion networks (Carroll & Teo, 1996). Our focus on a blue-collar sample may extend our understanding of diversity's complex role in the workplace by highlighting the shifting importance of various types of demographic and structural diversity in different organizational settings. By extending past examinations of diversity beyond its effects on top management team (e.g., Bantel & Jackson, 1989; Hambrick & Mason, 1984; Michel & Hambrick, 1992) and professional work group performance (Lincoln & Miller, 1979), this study

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provides insight into the wider applicability of past diversity research findings and suggests that structural diversity may play different roles depending on the nature of the work context.

The study is limited because the sample consisted of only 19 work teams. The statistical tests may be unstable and the lack of statistical power may lead to the rejection of true hypotheses. We have attempted to correct the situation by testing for normality assumptions, reporting adjusted *r*-squares, and using two-tailed tests. We also used multiple sources of data so as to avoid inflated correlations due to mono-method bias.

The managerial implications of our research are threefold. First, to the extent that managers desire more cohesive teams, there may be advantages in mixing together older and younger members. Second, to the extent that teams are working together routinely with interdependence between team members, the effects on team performance of surface level diversity—based on ethnicity and gender—may be less apparent than previous theory has suggested. Third, the effects of diversity on team performance may be more evident with respect to social structure than with respect to demographic differences. Team leaders may seek to reinforce moderate levels of structural differentiation and to counteract tendencies toward too much fragmentation or the establishment of a single clique.

Individuals assigned to work teams make mutual decisions concerning friendship links, and these accumulated links form structural patterns of more or less fragmentation at the team level. Our research suggests that the twin perils of too much social fragmentation or too much cohesion at the team level can damage productivity. The management of structural differentiation may thus be an important team-level task.

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References

Agresti, A., & Finlay, B. (1997). *Statistical methods for the social sciences* (3rd ed.). Upper Saddle River: Simon and Schuster.

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly*, *45*, 425–455.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Baker, W. E., & Iyer, A. (1992). Information networks and market behavior. *Journal of Mathematical Sociology*, *16*, 305–332.

Baker, W. E., & Obstfeld, D. (1999). Social capital by design: Structures, strategies, and institutional contexts. In R. T. Leenders, & S. M., Gabbay (Eds.), *Corporate social capital and liability*. Norwell, MA: Kluwer Academic Publishers.

Balkundi, P., & Kilduff, M. (2005). The ties that lead: A social network approach to leadership. *Leadership Quarterly*, *6*, 941–961.

Balkundi, P., & Harrison, D. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *Academy of Management Journal*, *49*, 49–68.

Bantel, K. A., & Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal, 10*, 107–124.

Barker, J. (1993). Tightening the iron case: Concertive control in self-managing teams. *Administrative Science Quarterly*, *38*, 408–437.

Barrick, M., Stewart, G., Neubert, M. J., & Mount, M. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of Applied Psychology*, *83*, 377–391.

Barsness, Z. I., Diekmann, K. A., & Seidel, M. D. L. (2005). Motivation and opportunity: The role of remote work, demographic dissimilarity, and social network centrality in impression management. *Academy of Management Journal*, *48*, 401–419.

Bedeian, G. A., & Mossholder, W. K. (2000). On the use of coefficient of variation as a measure of diversity. *Organizational Research Methods*, *3*, 285–297.

Berkman, L. F., & Syme, S. L. (1979). Social networks, host resistance, and mortality: A nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology*, *109*, 186–204.

Blau, P. M. (1977). *Inequality and heterogeneity: A primitive theory of social structure*. New York: Free Press.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *UCINET for windows: Software for social network analysis*. Harvard: Analytic Technologies.

Brass, D. J. (1984). Being in the right place: A structural analysis of individual influence in an organization. *Administrative Science Quarterly*, *29*, 518–539.

Burt, R. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Burt, R. (2004). Structural holes and good ideas. *American Journal of Sociology*, *110*, 349–399.

Burt, R. (2005). *Brokerage and closure: An introduction to social capital*. Oxford, England: Oxford University Press.

Burt, R. S. (2007). Second-hand brokerage: Evidence on the importance of local structure for managers, bankers, and analysts. *Academy of Management Journal, 50* (in press) .

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DOI: 10.1002/job

Burt, S. R., & Ronchi, D. (1990). Contested control in a large manufacturing plant. In J. Weesie, & H. D. Flap (Eds.), *Social networks through time* (pp. 127–157). Utrecht: Isor.

Byrne, D. (1971). *The attraction paradigm*. New York: Academic Press.

Campion, M. A., Papper, E. M., & Medsker, G. J. (1996). Relations between work team characteristics and effectiveness: A replication and extension. *Personnel Psychology*, *49*, 429–452.

Carroll, G. R., & Teo, A. C. (1996). On the social networks of managers. *Academy of Management Journal*, *39*, 421–440.

Chattopadhyay, P. (1999). Beyond direct and symmetrical effects: The influence of demographic dissimilarity on organizational citizenship behavior. *Academy of Management Journal*, *42*, 273–287.

Cohen, S., Doyle, W., Skoner, D., Rabin, B. S., & Gwaltney, J. M. (1997). Social ties and susceptibility to the common cold. *Journal of the American Medical Association*, *277*, 1940–1944.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, *23*, 239–290.

Coleman, J. S. (1990). *Foundations of social theory.* Cambridge, MA: Harvard University Press.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297–334.

Cross, R., & Parker, A. (2004). *The hidden power of social networks: Understanding how work really gets done in organizations*. Boston: Harvard Business School Press.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, *7*, 117–140.

Finkelstein, L., Burke, M., & Raju, N. (1995). Age discrimination in simulated employment contexts: An integrative analysis. *Journal of Applied Psychology*, *80*, 652–663.

Friedkin, N. E. (1981). The development of structure in random networks: An analysis of the effects of increasing network density on five measures of structure. *Social Networks*, *3*, 41–52.

Gibbons, D. E., & Olk, P. M. (2003). Individual and structural origins of friendship and social position among professionals. *Journal of Personality and Social Psychology*, *84*, 340–351.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, *78*, 1360–1380.

Granovetter, M. S. (1974). *Getting a job: A study of contacts and careers*. Cambridge, MA: Harvard University Press.

Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, *47*, 307–338.

Hambrick, D. C. (1994). Top management groups: A conceptual integration and reconsideration of the 'team' label. *Research in Organizational Behavior*, *16*, 171–213.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as reflection of its top managers. *Academy of Management Review*, *9*, 193–206.

Hansen, M. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organizational subunits. *Administrative Science Quarterly*, *44*, 82–111.

Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. (2002). Time, teasms, and task performance: Changing effects of diversity on group functioning. *Academy of Management Journal, 45*, 1029–1045.

Holland, P., & Leinhardt, S. (1970). A method for detecting structure in sociometric data. *American Journal of Sociology*, *76*, 492–513.

Ibarra, H. (1992). Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Administrative Science Quarterly*, *37*, 422–447.

Ibarra, H., Kilduff, M., & Tsai, W. (2005). Zooming in and out: Individuals and collectivities at the new frontiers for organizational network research. *Organization Science*, *16*, 359–371.

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions and turnover. *Journal of Applied Psychology*, *76*, 675–689.

Jehn, K., & Mannix, E. (2001). The dynamic nature of conflict: A longitudinal study of intragroup conflict and group performance. *Academy of Management Journal*, *44*, 238–251.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a differences: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly*, *44*, 741–763.

Kapferer, B. (Ed.). (1972). *Strategy and transaction in an African factory.* Manchester: Manchester University Press.

Kilduff, M., Angelmar, R., & Mehra, A. (2000). Top management-team diversity and firm performance: Examining the role of cognitions. *Organization Science*, *11*, 21–34.

Krackhardt, D. (1999). The ties that torture: Simmelian tie analysis in organizations. In S. B. Bacharach, S. B. Andrews, & D. Knoke (Eds.), *Research in the sociology of organizations* (Vol. 16, pp. 183–210). Stanford, CT: JAI.

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DOI: 10.1002/job

Krackhardt, D., & Hanson, J. (1993). Informal Networks: The company behind the chart. *Harvard Business Review*, *71*, 104–111.
Lawrence, B. S. (1997). The black box of demography. *Organization Science*, *8*, 1–22.
Lau, D. C., & Murnighan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review, 23*, 325–340.
Lincoln, J. R., & Miller, J. (1979). Work and friendship ties in organizations: A comparative analysis of relation networks. *Administrative Science Quarterly*, *24*, 181–199.
Mannix, E., & Neale, M. A. (2005). What differences make a difference? The promise and reality of diverse teams in organizations. *Psychological Science in the Public Interest*, *6*, 31–55.
McGuire, W. J., McGuire, C. V., Child, P., & Fujimoto, T. (1978). Salience of ethnicity in the spontaneous self-concept as a function of one's ethnic distinctiveness in the social environment. *Journal of Personality and Social Psychology*, *35*, 63–78.
Mehra, A., Kilduff, M., & Brass, D. (1998). At the margins: A distinctiveness approach to the social identity and social networks of underrepresented groups. *Academy of Management Journal*, *41*, 441–452.
Mehra, A., Dixon, A. L., Brass, D. J., & Robertson, B. (2006). The social network ties of group leaders: Implications for group performance and leader reputation. *Organization Science*, *17*, 64–79.
Mehra, A., Kilduff, M., & Brass, D. J. (2001). The social networks of high and low self-monitors: Implications for workplace performance. *Administrative Science Quarterly*, *46*, 121–146.
Michel, J., & Hambrick, D. C. (1992). Diversification posture and the characteristics of the top management team. *Academy of Management Journal*, *35*, 9–37.
Oh, H., Chung, M. H., & Labianca, G. (2004). Group social capital and group effectiveness: The role of informal socializing ties. *Academy of Management Journal*, *47*, 860–875.
Oh, H., Labianca, G., & Chung, M. H. (2006). A multilevel model of group social capital. *Academy of Management Review*, *31*, 569–582.
Pelled, L. H. (1996). Demographic diversity, conflict, and work group outcomes: An intervening process theory. *Organization Science*, *7*, 615–631.
Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the Black box: An analysis of work group diversity, conflict and performance. *Administrative Science Quarterly*, *44*, 1–28.
Podolny, J. E., & Baron, J. N. (1997). Relationships and resources: Social networks and mobility in the workplace. *American Sociological Review*, *62*, 673–693.
Portes, A. (2000). The two meanings of social capital. *Sociological Forum*, *15*, 1–11.
Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, *41*, 116–145.
Roethlisberger, F., & Dickson, W. (1939). *Management and the worker*. Cambridge: Cambridge University Press.
Roy, D. (1954). Efficiency and 'The Fix': Informal intergroup relations in a piecework machine shop. *American Journal of Sociology*, *60*, 255–266.
Salancik, G. R. (1995). Wanted: A good network theory of organization. *Administrative Science Quarterly*, *40*, 345–349.
Schmidt, F. L. (1996). Statistical significance testing and cumulative knowledge in psychology: Implications for training of researchers. *Psychological methods*, *2*, 115–129.
Sedlmeier, P., & Gigerenzer, G. (1989). Do studies of statistical power have an effect on the power of studies? *Psychological Bulletin*, *105*, 309–316.
Seidel, M. D. L., Polzer, J. T., & Stewart, K. J. (2000). Friends in high places: The effects of social networks on discrimination in salary negotiations. *Administrative Science Quarterly*, *45*, 1–24.
Shah, P., & Jehn, K. (1993). Do friends perform better than acquaintances? The interaction of friendship, conflict and task. *Group Decision and Negotiation*, *2*, 149–165.
Shah, P. P., Dirks, K. T., & Chervany, N. (2006). The multiple pathways of high performing groups: The interaction of social networks and group processes. *Journal of Organizational Behavior*, *27*, 299–317.
Sherif, M. (1961). *Intergroup conflict and cooperation: The Robbers Cave experiment*. Norman: University Book Exchange.
Slotow, R., Van Dyk, G., Poole, J., Page, B., & Klocke, A. (2000). Older bull elephants control young males. *Nature*, *408*, 425–426.
Tajfel, H., & Turner, J. (1986). The social identity of intergroup behavior. In S. Worchel, & W. Austin (Eds.), *Psychology and intergroup relations* (pp. 7–24). Chicago: Nelson-Hall.
Tsui, A. S., Egan, T. D., & O'Reilly, C. A. (1992). Being different: Relational demography and organizational attachment. *Administrative Science Quarterly*, *37*, 549–579.

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DOI: 10.1002/job

Tsui, A. S., & O'Reilly, C. A., III. (1989). Beyond simple demographic effects: The importance of relational demography in superior-subordinate dyads. *Academy of Management Journal*, *32*, 402–423.
Wagner, W., Pfeffer, J., & O'Reilly, C. A., III. (1984). Organizational demography and turnover in top management groups. *Administrative Science Quarterly*, *29*, 74–92.
Watson, W. E., Michaelson, L. K., & Sharp, W. (1991). Member competence, group interaction, and group decision making: A longitudinal study. *Journal of Applied Psychology*, *76*, 803–809.
Webber, S. S., & Donahue, L. M. (2001). Impact of highly and less job-related diversity on work group cohesion and performance: A meta-analysis. *Journal of Management*, *27*, 141–162.
Weldon, E., Jehn, K. A., & Pradhan, P. (1991). Processes that mediate the relationship between a group goal and improved group performance. *Journal of Personality and Social Psychology*, *61*, 555–569.
West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with non-normal variables: Problems and remedies. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 56–75). Thousand Oaks, CA: Sage.
White, H. (1961). Management conflict and sociometric structure. *American Journal of Sociology*, *67*, 185–199.
Wilkinson, L., & Task Force on Statistical Inference. (1999). Statistical methods in psychology journals. *American Psychologist*, *54*, 594–604.
Williams, K. Y., & O'Reilly, C. A., III. (1998). Demography and diversity in organizations. *Research in Organizational Behavior*, *20*, 77–140.
Zenger, T. R., & Lawrence, B. S. (1989). Organizational demography: The differential effects of age and tenure distributions on technical communication. *Academy of Management Journal*, *32*, 353–376.

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